Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, D.C.

In the Matter of	)
	) CC Docket No. 94-102
Revision of the Commission's Rules To	)
Ensure Compatibility with Enhanced 911	)
Emergency Calling Systems	)

DOCKET FILE COPY ORIGINAL

COMMENTS OF THE
AD HOC ALLIANCE FOR PUBLIC ACCESS TO 911
CONCERNING THE FURTHER NOTICE OF
PROPOSED RULEMAKING

On July 26, 1996 the Commission issued its Report and Order ("R&O") and Further

Notice of Proposed Rulemaking ("FNPRM") in the above captioned docket. The Commission

has asked for additional comments concerning the following: (1) What steps should be taken to

provide PSAP with information that locates a wireless 911 caller; (2) The Alliance proposal

requiring 911 calls to be sent to the cellular system with the strongest compatible control signal;[1]

(3) What steps can be taken to enable 911 calls to be completed over any wireless system from

any handset without regard to the differences in system technology; and, (4) The scope of the

consumer education program concerning the use of 911 and the obligation of various parties with

respect to that program. The Ad Hoc Alliance for Public Access to 911 ("Alliance") hereby

submits its comments to the Further Notice of Proposed Rulemaking as follows:

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[1] The Alliance proposal was modified to select the strongest compatible signal in response to comments concerning
compatibility. See Reply Comments of the Ad Hoc Alliance For Public Access to 911, January 16, 1996, page 5-
6.

SUMMARY

Requiring all new wireless handsets to connect 911 calls to the strongest compatible signal is compelled by the public interest. We show herein that incorporating this feature requires only a simple, inexpensive software change. This change will ensure that all consumers have the best chance of reaching 911 in an emergency, that the 911 operators have the best chance of receiving a clear voice at the other end of the call, and that the caller can better be located within the radius of the nearest base station.

The Alliance continues to believe that all 911 wireless calls, even those from non service initialized handsets, should be passed through to the appropriate PSAP. One concern raised previously was that calls from non-initialized handsets could not be returned by the PSAP. We have included documentation describing how such call back capaqbility can be easily and effectively accomplished.

The Alliance also recommends that the wireless industry should provide for repayment to local and state governments for the cost of implementing new locational technology out of new revenue streams accruing to the industry from commercial uses of that technology. Finally, the Alliance urges the Commission to implement a national public information campaign concerning accessing 911 services via wireless phones.

Attached to these comments are several important documents that support the proposals made by the Alliance. The Alliance has commissioned an independent study by Trott

Communications Group, Inc. (hereafter referred to as Trott) of the feasibility of the Alliance

proposal concerning selection of the strongest compatible signal for 911 calls. A copy of the

Trott report is attached hereto as Appendix A. The Alliance has also conducted two additional

tests which compare the signal strength of the cellular systems in Atlanta, Georgia and Dallas,

Texas. The results of these tests are attached hereto as Appendices B and C. Appendix D is a

copy of a recent news article illustrating the need for automatic selection of the strongest signal

in emergency situations. Appendix E outlines a proposed solution to callback issues with respect

to roamers, with or without a roaming agreement, non-service initialized phones and handsets

that contain a MIN that has been reassigned or deactivated. This was prepared for the Alliance

by Mr. F.G. "Spike" Fuson of Vista Telecom.

LOCATION INFORMATION TECHNOLOGY

The Commission has required covered carriers to relay the location of the base station or

cell site receiving a 911 call to the Public Service Answering Point (PSAP).[2] The Commission

has asked for comments with suggestions of how to make "efficient use of communications

technology to improve the accuracy and reliability of this location information."[3]

The Alliance proposal that requires 911 calls to be carried over the strongest compatible

signal will enhance greatly the ability of the local PSAP to locate the caller. The location of the

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[2] R&O, para. 63. Within five year after the effective date of the rules adopted in the R&O, covered carriers must supply information that locates a caller within a radius of 125 meters.
[3] FNPRM para 135.

receiving site is of value to the PSAP to the extent that it provides the location of the calling party within the range of the base station receiving the cell phone signal. However, the longer the distance between the caller and the receive location, the greater the radius within which the caller may be located and the less useful the information. Under the current rules, the base station or cell site which receives the 911 call may not be the receiver site nearest to the calling party. As the tests conducted by the Alliance show, there is a significant variation between signal strengths between the A side and the B side of cellular carriers in the service areas investigated because the receiver towers are located in different places. Thus, even when both the A side and the B side cellular systems can be accessed, the use of the strongest signal enhances the ability of the PSAP to locate the calling party because that party will be within a smaller radius from the receiver location.

The Commission has asked whether it should establish parameters for future standards with regard to ALI technology in order to encourage the development of such equipment. The Alliance believes that this is a wise approach and that the bar should be placed as high as possible. The Alliance intends to participate fully in the discussions with the other parties, as mandated by the Commission, to promote the development and deployment of additional ALI technology to meet the safety needs of the public.

The Alliance believes that many of these new technologies will offer opportunities to provide other services which will more than compensate the carrier for the cost of deployment of such technology. Although not requested in the Further Notice of Proposed Rulemaking, the

Alliance suggests that the Commission establish a set of guidelines for local PSAPs and cellular

carriers to follow in developing joint agreements for the deployment of ALI technologies. Given

the scarce resources available for state and local governments to deploy this new technology,

these agreements should include provisions for the carrier to reimburse the PSAP for public

funds used to deploy ALI technology out of new revenue streams that accrue to the carrier as a

result of the availability of these new technologies.

ACCESS TO 911 SERVICE VIA MULTIPLE MOBILE SYSTEMS

A. Technical Issues

The Alliance originally asked in its Petition for Rulemaking that the Commission amend

its rules to require the cellular phone to select the strongest signal when a 911 call is placed.

Two comments filed in response to the Petition and included under the Further Notice of

Proposed Rulemaking caused the Alliance to re-examine its position.

First, was the issue of incompatible air interfaces between different types of mobile

systems. The Alliance adjusted its previous request for rulemaking to accommodate this concern

by specifying that the cellular phone should be programmed to select the strongest **compatible**

signal.[4] The Commission went beyond the Alliance proposal to ask for comments "regarding

how to achieve the goal of enabling wireless 911 service to be available and accessible wherever

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[4] Alliance Reply Comments, January 16, 1996, page 5-6.

a qualifying mobile system is present."[5] The Commission specifically asked for comments concerning "partial solutions" rather than the simple response "not possible". The Alliance commissioned a study by Trott to address this issue as well as the issue of strongest compatible signal in a combined report. A copy of the Trott report is attached as Appendix A. In their opinion, the cellular industry is unlikely to convert all of their channels from the analog format because to do so would be to eliminate or severely reduce the capability of their customers to roam. Trott points out that dual-mode cell phones are being developed and deployed to enable customers to use the analog format as well as other formats for this reason. Thus, if the Alliance proposal is adopted, the dual-mode cell phone when used to place a 911 call would automatically search out the strongest compatible signal. This achieves the result sought by the Alliance and greatly enhances the public safety when using 911.

We believe that market factors will drive emerging systems to adopt a ubiquitous air interface that will permit their customers to roam from one area to another. However, this does not mean that competing or different types of wireless systems will adopt the same standard. It would be very desirable for users of different systems to place 911 calls over any system. One solution to this problem is that all wireless phones be equipped to operate over a separate, unlicensed, cordless phone 900 MHz spectrum, dedicated for 911 calls, and that all covered carriers be required to handle such calls.

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[5] FNPRM para 148.

Second, the Commission has asked for comments concerning the Alliance test and its proposal that the cellular handset select the strongest signal whenever a 911 call is made. The Commission specifically asked for comments "from a technical feasibility standpoint."[6] In response, the Alliance commissioned a study by Trott of the technical feasibility of seeking the strongest available signal for cellular phones. This study concludes that a minor adjustment to the software in cell phones would accomplish the Alliance objective and would not place an undue burden on manufacturers.[7] The software adjustment allows the cell phone, for 911 calls only, to scan all available control channels, both A and B side when selecting the strongest available signal. The Alliance proposed that this requirement be implemented through the equipment authorization process.

Also of concern under this same issue was the assertion that there was really little difference between the coverage of the two cellular systems operating in the same service area. The Alliance responded by conducting a test in Los Angeles, California to determine the truth of this assertion. The results were surprising and disturbing. The Alliance test found that from the perspective of portable cellular telephone users, the coverage areas of the two cellular systems resembled pieces of Swiss cheese. Fortunately, when overlaid one upon the other, these two systems combined to fill in the holes. The Alliance has now conducted two more tests, one in Atlanta and the other in Dallas. In Atlanta the test results show very significant gaps in coverage where even the most powerful mobile telephone units cannot reach one cellular carrier, but could reach the other carrier in many areas. This situation is even more critical when a portable cell

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[6] FNPRM, para. 144.
[7] See Appendix A.

phone is used. The test results for Atlanta are included as Appendix B. The results in Dallas did not show the same difference in coverage largely due to a preponderance of co-located base stations between the two carriers in the service area.. However, one system was stronger than the other about one third of the time. The results of the Dallas tests are included in Appendix C. These tests confirm the problem facing cellular callers who may be unable to complete a 911 call in many parts of their own service area and reinforce our belief that requiring the strongest compatible signal will help overcome this problem. Also attached as Appendix D is a copy of a recent news article reporting the efforts of three different cell phone users (two unsuccessful) to report an automobile accident. This article is another example of the importance of selecting the strongest compatible signal in emergency situations.

It is important to point out that requiring 911 calls to be connected through the strongest compatible signal also accrues substantial benefits to the PSAP:

1. It is critical that 911 calls not only go through but be connected to the appropriate PSAP. Calls going through a distant base station could be transmitted to the wrong PSAP. Allowing 911 calls to connect with the closest, and strongest compatible signal will help assure the right PSAP receives the call.

2. With implementation of the new ALI requirements contained in the FCC's Order, PSAPs will be able to identify the location of the base station receiving the 911 call. However, if the call does not connect with the strongest available compatible signal the actual location of the

caller will be far harder to identify as the base station handling the call may be located several additional miles away.

3. Requiring the call to be connected to the strongest available compatible signal will also greatly improve the quality of the signal and clarity of the call. This will help the PSAP in getting the right information as quickly as possible and reduce the need for the caller to call again or the PSAP to make a call back.

4. Results of the tests in the three metropolitan areas prove conclusively that, absent a requirement to connect 911 calls to the strongest available compatible signal, cellular callers in many communities are in jeopardy of not being able to reach 911 services.

B. 911 Availability and Consumer Education

The Commission has asked for comment on whether non-code identification calls should be passed to PSAPs after one year without regard to a request from the PSAP for such calls. The Alliance believes that *all* 911 calls should be passed to the PSAP. Under the R&O, all callers using wireless phones to call 911, including callers using non-service initialized phones, will have the same ALI information transmitted to the PSAP. In addition, the Alliance has included, as Appendix E, an effective way to resolve the call back issues raised in this proceeding through the use of a substitute local telephone number plan. The Alliance intends to share this proposal

with industry and public safety groups in order to reach a common agreement on methods to allow PSAPs to make call backs to any wireless phone.

The Commission also asked for comments on whether education of users about how to program their mobile units to change systems might accomplish the objective of selection of the strongest signal. While the cellular industry does not publish this information, our estimate is that about 50% to 60% of all cell phones are programmed either "A" side only or "B" side only. This equates to approximately 18 million cell phones which are set to search only A or only B side. Approximately 9 to 10 million new cell phones are projected to be sold next year. We expect over half of these phones to be programmed for one side only. This prevents the cell phone users from discovering what the Alliance tests show with respect to the difference in coverage. Thus, the user of "A" side only may not know that the routes usually traveled by him or her are better covered by the "B" side and vice versa.

If the cell phone is reprogrammed to search both the A and B side it is on the basis of one side "preferred". Thus, if the cell phone is set for A side preferred and there is a usable signal from that system it will be selected even though there is a better signal from the B side at that location. This alternative does not achieve the benefits realized when the strongest compatible signal is automatically selected in emergency situations. An additional problem with this solution is that it imposes an expense on the cell phone user that is unnecessary. It also means that the cell phone user may inadvertently place a more expensive roamer call without intending to do so.

There is also the possibility of re-programming the cell phone to change systems. The instructions for such changes are in the cell phone manual and somewhat akin to the instructions of how to use a VCR. This is simply not a viable solution in emergency situations.

We strongly urge the Commission to pursue the creation of a national public information campaign that would inform consumers about the capabilities and limitations of wireless systems when accessing 911 services. This should be conducted in joint cooperation with the Cellular industry and consumer groups as well as organizations representing the public safety communications community and funded by the wireless industry. The details of such a public information campaign should be jointly developed in conversations with all three groups. However, we suggest several components that should be included:

1. The creation of a uniform set of information that would be distributed to all current customers, distributed with the purchase of any new wireless phone, and made available on relevant sites on the Internet including the FCC and wireless industry sites should be considered;

2. Instructions to be distributed with all cell phones that provide users with the ability to use the "system select criteria" menu, allowing restricted phones to roam between A and B side; and appropriate warnings that tell consumers about the additional costs that may be incurred by using an A or B side roaming option for normal (non-911) calls.

CONCLUSION

We agree with the Commission when it said "[we] must find ways, however, to make wireless 911 service as ubiquitous and transparent as possible to the using public."[8] The Alliance's proposed rule change that mandates selection of the strongest compatible signal by the cell phone when 911 is dialed is achievable now at a minimum cost and will be a significant step forward towards the Commission's objective.

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[8] FNPRM para. 153.

ATTACHMENT A

TROTT
COMMUNICATIONS GROUP

FEASIBILITY OF SELECTING THE STRONGEST COMPATIBLE CELLULAR SIGNAL

REPORT PREPARED FOR

AD HOC ALLIANCE FOR PUBLIC ACCESS TO 9-1-1

BY

TROTT COMMUNICATIONS GROUP, INC.

AUGUST 27, 1996

INTRODUCTION:

The Ad Hoc Alliance for Public Access to 9-1-1 (Alliance) has proposed that the Commission adopt a rule change that will require all wireless handsets to automatically select the strongest compatible signal when the user dials 9-1-1. Under the Alliance proposal, the process of selecting the strongest signal will automatically eliminate incompatible signals. This proposal is easily achievable and will impose a minimal burden on manufacturers compared to the benefits provided to the user.

The Commission has also asked for comment concerning ways for mobile users to complete a 9-1-1 call to any available wireless system without regard to system compatibility. In consideration of this issue, it is impractical to require wireless handset manufacturers to support a multitude of frequency bands, modulation types, signaling formats and protocols. It is equally impractical to require wireless service providers to construct systems to support a multitude of frequency bands, modulation types, signaling formats and protocols. It is even more impractical from the Commission's standpoint to re-assign spectrum in each frequency band from one wireless service provider to several competing wireless service providers to support such activities. Due to these impracticalities, this report will address 9-1-1 access only from a cellular perspective.

As a practical matter, most cellular carriers will ensure inter-system compatibility to offer roaming service in order to remain competitive in the marketplace. This will require such service providers to continue to dedicate some spectrum to analog service and handset manufacturers to produce dual-mode analog/digital equipment to accommodate the needs of the roaming subscriber. Thus, a 9-1-1 call can be switched to the strongest, compatible (analog or digital) signal.

GENERAL:

Cellular handsets are designed, manufactured and programmed in compliance with appropriate industry standards to ensure compatibility between the Mobile Station (MS) and Base Station (BS). These standards were prepared by Electronic Industries Association (EIA) and Telecommunications Industry Association (TIA) and published as EIA/TIA Standards. These Standards were reviewed and approved by the F.C.C. and incorporated into their Rules and Regulations by reference. The majority of the cellular handsets in service today are compatible with the original OST-53 analog standard (AMPS). Some are also compatible with one of the digital standards.

Unlike other wireless services, Cellular Radio Telephone Service was initially implemented using analog technology and some systems were subsequently upgraded to one of the standardized digital technologies. In order to retain compatibility with the existing subscriber base and to remain compatible with all other cellular providers in providing roamer service, cellular service providers are retaining analog service; i.e., some channels operate in the analog mode while others operate in a digital format (TDMA, CDMA). In addition, cellular subscriber units are being manufactured as dual-mode; i.e., analog and digital. As a result, most cellular handsets will continue to be compatible with current cellular systems in the analog (AMPS) mode of operation.

COMPATIBILITY ISSUES:

The nationwide deployment of digital cellular is not following a single standard as was the deployment of analog cellular. In some cities, one cellular provider is implementing TDMA in addition to analog while the other is implementing CDMA in addition to analog. In addition, deployment of digital is in isolated areas and not ubiquitous.

The Commission's <u>REPORT AND ORDER AND FURTHER NOTICE OF PROPOSED RULEMAKING</u> CC Docket No. 94-102 / RM-8143, specifically Paragraph 146 and related Footnote 288, ignores one of the central and material parts of the Alliance's request, that wireless handsets automatically select the strongest, **COMPATIBLE** signal when the user dials 9-1-1. Cellular handsets will not recognize or "lock-onto" a stronger signal with an incompatible format. For example, a CDMA handset looks for CDMA pilot channels which are totally different from analog control channels and a TDMA handset looks for TDMA digital control channels which are totally different from analog control channels. In addition, analog-only handsets will not recognize either TDMA or CDMA control or pilot channels. Furthermore, digital (dual-mode) phones will search for analog control channels if no compatible digital signaling is found; therefore, a dual-mode handset could, if so directed, search both format-compatible digital control or pilot channels in addition to analog control channels to determine the strongest compatible system. In light of the ubiquitous nature of the analog networks and better audio quality at this time in the deployment process, it may be preferable to place all 9-1-1 calls in the analog portion of

the wireless networks. This would also speed up the deployment of handset location due to technical limitations of digital location technology, especially CDMA. Digital technologies are intended to benefit the service providers by increasing capacity in a fixed bandwidth, and may in some future generation, provide close to equal voice quality.

REVIEW OF CURRENT PROCESS:

This review is based upon the original OST-53 compatibility specification since all analog operations are backwards compatible to support the original MS equipment. Upon application of power, the MS in a cellular system will perform the *INITIALIZATION* Task (2.6.1) and then enter the *IDLE* Task (2.6.2). The MS will remain in this *IDLE* mode of operation waiting for either a BS or user event. Periodically, the MS will re-scan the cellular environment to ensure itself of current data and accessibility to cellular service.

When the MS user places a call, the MS will exit the *IDLE* task and enter the *SYSTEM ACCESS* Task (2.6.3) with the Origination Flag set. The *SYSTEM ACCESS* Task begins with *SET ACCESS PARAMETERS* Task (2.6.3.1) which defines the basic time allowance for the MS to complete the access attempt. The *SYSTEM ACCESS* Task then continues with the *SCAN ACCESS CHANNELS* Task (2.6.3.2) which instructs the MS to examine the signal strength of ALL control channels beginning with FIRSTCHA and ending with LASTCHA looking for the strongest two channels in the group. The *INITIALIZATION* Task (2.6.1) set the FIRSTCHA and LASTCHA parameters to encompass the control channels associated with the preferred serving system, either the A-Side channel set or the B-Side channel set. Therefore, the MS will only look at the access channels for one of the available cellular service providers in the area.

Once the *SCAN ACCESS CHANNELS* Task completes, the MS is tuned to the strongest channel and the *RETRIEVE ACCESS ATTEMPTS PARAMETER* Task (2.6.3.3) is entered. This task informs the MS as to the allowable number of access attempts it will be permitted to try before access failure is declared. The MS then enters the *UPDATE OVERHEAD INFORMATION* Task (2.6.3.4) to insure compliance with the serving system registration and authentication requirements. The MS will then enter the *SEIZE REVERSE CONTROL CHANNEL* Task (2.6.3.5) where it will attempt to pass the Origination request to the serving system.

The processing of this origination call will remain with the selected serving system until call termination or until the serving system hands off the call to a neighboring system if both systems are part of a wide area seamless service agreement. Upon call termination, the MS will enter the *SERVING SYSTEM DETERMINATION* Task (2.6.3.12), which will re-scan the cellular environment before returning to the *IDLE* Task.

3

PROPOSED CHANGES TO THE PROCESS:

The Ad Hoc Alliance for Public Access to 9-1-1 has proposed a change to the above call process for 9-1-1 calls to be directed to a Public Safety Answering Point (PSAP) from a MS by all cellular service providers. This change is defined as a requirement for the MS to examine ALL control channels for both the A-Side and B-Side service providers to select the strongest compatible channel to process the call without regard to their preferred service provider. This change will ensure the MS user of access to the best communication path to process the emergency call. This process will also enable the locating process to more accurately report the true location of the MS when only the location of the BS cell site is being reported to the PSAP; i.e., the first five years following adoption of the new regulations. It will also reduce the probability of dropped or uncompleted calls and minimize the requirement for call-back by the PSAP.

IMPACT OF THE PROPOSAL ON THE CALL PROCESS:

Incorporating the proposed change into the MS is limited to a relatively minor software modification. The SET ACCESS PARAMETERS Task (2.6.3.1) is modified to examine the dialed number to determine if 9-1-1 is being called. If the user has dialed 9-1-1, this task, (2.6.3.1) is expanded to pre-load the FIRSTCHA parameter with the lowest A-Side control channel (313) and the LASTCHA parameter with the highest B-Side control channel (354) in addition to the task's normal process. As a result of this minor change, the following task, SCAN ACCESS CHANNELS Task (2.6.3.2) will examine **ALL** control channels for both the A-Side and B-Side when selecting the strongest compatible signal.

The remainder of the call process will proceed with **NO** changes required, and as a result, the user will always select the BEST compatible channel from BOTH cellular systems when calling 9-1-1. This change will NOT affect any other calls made by the user. The non-9-1-1 calls will be placed on the preferred system selected by the user.

CONCLUSION:

In summary, the proposal by the Alliance to "Seek the Strongest Compatible Signal" when placing a call to 9-1-1 is achievable with very little impact on the equipment manufacturer, while providing the benefit of the best possible reliability to the user and providing the closest cell site information to the PSAP. This proposed change will also benefit the PSAP by minimizing the probability of dropped or uncompleted calls requiring call-back by either the PSAP or the user.

4

ATTACHMENT B

GREATER ATLANTA
CELLULAR SYSTEM SURVEY

On August 10, 1996, a Cellular System coverage survey was conducted in Atlanta, GA. This survey included two hundred seventy five square miles of area encompassing portions of Decalb, Gwinnett and Fulton counties. The survey was performed at the request of the Ad Hoc Alliance for Public Access to 9-1-1.

The results of this survey point out and document the dramatic difference in the coverage of the competing A-Side and B-Side cellular carriers. Attached are maps depicting the route travelled during this survey with measurement locations marked and numbered. The actual measurements were captured by an LCC MSAT cellular system test set and printed out in real time.

The results of these printouts have then been graphed to illustrate the best available signal at each of the twenty-nine locations and to emphasize the "Difference" in decibels between the two systems. Every four decibels of difference represents a "DOUBLING" of the available signal power. Many of the sites shown have a difference level in excess of forty decibels (1024 times more signal) with several in excess of fifty-two decibels (8192 times more signal).

Although this survey was not exhaustive, it demonstrates that there is a very dramatic difference in the coverage of the competing cellular systems in the greater Atlanta market.

GREATER ATLANTA
CELLULAR SYSTEM SURVEY

LOCATION	MEASUREMENTS
MAP **IDENT.**	

1   **1**

Talbot St. & Ascot Lane
Roswell, GA

```
MARKER      5   07:52:26   08-10-96
         A BAND                B BAND
   CHAN GRP   DBM      CHAN GRP   DBM
 ▸ 314   02  -103      349   16   -90
   330   18  -104      347   14  -103
   320   08  -106      341   08  -104
   324   12  -108      336   03  -105
   313   01  -109      338   05  -106
   323   11  -110      340   07  -109
```

1   **2**

Millbank & Ascot Lane
Roswell, GA

```
MARKER      6   07:57:03   08-10-96
         A BAND                B BAND
   CHAN GRP   DBM      CHAN GRP   DBM
 ▸ 330   18   -92      349   16  -105
   327   15  -102      338   05  -109
   331   19  -104      341   08  -109
   314   02  -105      347   14  -109
   318   06  -109      342   09  -109
   320   08  -110      352   19  -111
```

```
MARKER      7   07:57:06   08-10-96
         A BAND                B BAND
   CHAN GRP   DBM      CHAN GRP   DBM
 ▸ 330   18   -95      349   16   -90
   327   15  -103      341   08   -96
   318   06  -103      338   05  -103
   314   02  -103      342   09  -109
   320   08  -106      346   13  -112
   325   13  -106      340   07  -112
```

1   **3**

Mt. Pisgah Church
Nesbit Ferry Road
Alpharetta, GA

```
MARKER      8   08:02:19   08-10-96
         A BAND                B BAND
   CHAN GRP   DBM      CHAN GRP   DBM
 ▸ 330   18   -90      349   16   -65
   325   13   -97      343   10   -92
   320   08   -98      350   17   -95
   318   06  -100      341   08   -97
   314   02  -101      348   15   -97
   323   11  -103      346   13   -98
```

1   **4**

Nesbit Lakes & Nesbit Ferry Road
Alpharetta, GA

```
MARKER      9   08:03:44   08-10-96
         A BAND                B BAND
   CHAN GRP   DBM      CHAN GRP   DBM
 ▸ 330   18   -91      349   16   -52
   314   02   -93      350   17   -83
   331   19   -94      348   15   -84
   318   06   -96      341   08   -94
   327   15   -96      336   03   -95
   319   07   -97      338   05   -99
```

1   **5**

Scott Road & Nesbit Ferry Road
Alpharetta, GA

```
MARKER     10   08:04:38   08-10-96
         A BAND                B BAND
   CHAN GRP   DBM      CHAN GRP   DBM
 ▸ 331   19   -79      349   16   -44
   325   13   -80      350   17   -71
   313   01   -83      348   15   -74
   318   06   -87      342   09   -85
   330   18   -87      340   07   -87
   320   08   -88      346   13   -88
```

```
MARKER     11   08:05:35   08-10-96
         A BAND                B BAND
   CHAN GRP   DBM      CHAN GRP   DBM
 ▸ 318   06   -80      349   16   -31
   331   19   -82      350   17   -64
   326   14   -85      348   15   -68
   330   18   -89      342   09   -80
   325   13   -89      340   07   -89
   328   16   -90      341   08   -91
```

GREATER ATLANTA
CELLULAR SYSTEM SURVEY

LOCATION

MAP **IDENT.**

MEASUREMENTS

1	6

Nesbit Ferry Road & Abbottswell
Alpharetta, GA

MARKER   12   08:06:31   08-10-96

A BAND			B BAND		
CHAN	GRP	DBM	CHAN	GRP	DBM
▸ 315	03	-77	349	16	-38
320	08	-88	350	17	-70
331	19	-88	348	15	-72
318	06	-89	342	09	-91
330	18	-91	353	20	-93
326	14	-91	341	08	-93

1	7

Nesbit Ferry Road
Alpharetta, GA

MARKER   13   08:07:05   08-10-96

A BAND			B BAND		
CHAN	GRP	DBM	CHAN	GRP	DBM
▸ 313	01	-83	349	16	-35
326	14	-87	350	17	-68
331	19	-89	348	15	-69
325	13	-91	341	08	-85
314	02	-91	337	04	-92
332	20	-91	343	10	-93

MARKER   14   08:07:14   08-10-96

A BAND			B BAND		
CHAN	GRP	DBM	CHAN	GRP	DBM
▸ 313	01	-82	349	16	-35
318	06	-88	350	17	-67
326	14	-88	348	15	-69
314	02	-88	341	08	-87
325	13	-88	336	03	-91
331	19	-89	343	10	-92

1	8

Nesbit Ct. & Nesbit Ferry Road
Alpharetta, GA

MARKER   15   08:07:20   08-10-96

A BAND			B BAND		
CHAN	GRP	DBM	CHAN	GRP	DBM
▸ 313	01	-83	349	16	-31
326	14	-87	350	17	-66
331	19	-87	348	15	-68
318	06	-88	341	08	-84
325	13	-88	336	03	-88
314	02	-90	345	12	-91

MARKER   16   08:07:24   08-10-96

A BAND			B BAND		
CHAN	GRP	DBM	CHAN	GRP	DBM
▸ 313	01	-82	349	16	-31
331	19	-84	350	17	-66
326	14	-86	348	15	-68
318	06	-88	341	08	-83
325	13	-89	336	03	-87
332	20	-90	345	12	-91

2	9

Nesbit Ferry Rd & Holcomb Bridge Rd
Roswell, GA

MARKER   17   08:11:50   08-10-96

A BAND			B BAND		
CHAN	GRP	DBM	CHAN	GRP	DBM
▸ 331	19	-60	349	16	-98
332	20	-87	337	04	-101
330	18	-96	348	15	-103
320	08	-97	343	10	-105
326	14	-104	345	12	-108
329	17	-105	342	09	-109

GREATER ATLANTA
CELLULAR SYSTEM SURVEY

LOCATION

MAP **IDENT.**

MEASUREMENTS

MAP	IDENT.	Location
2	10	Rivermont Shopping Center, Roswell, GA
2	11	Rivermont Shopping Cemter, Roswell, GA
2	12	Rivermont Shopping Center, Roswell, GA
3	13	Holcomb Bridge Rd & Spalding Rd, Norcross, GA

MARKER 18 08:17:24 08-10-96

A BAND			B BAND		
CHAN	GRP	DBM	CHAN	GRP	DBM
331	19	-43	349	16	-91
332	20	-72	341	08	-95
330	18	-74	353	20	-98
313	01	-95	337	04	-100
315	03	-97	340	07	-100
314	02	-100	342	09	-102

MARKER 19 08:18:56 08-10-96

A BAND			B BAND		
CHAN	GRP	DBM	CHAN	GRP	DBM
331	19	-31	349	16	-82
332	20	-68	344	11	-82
330	18	-69	348	15	-88
315	03	-86	337	04	-90
313	01	-93	353	20	-94
319	07	-97	345	12	-94

MARKER 20 08:19:49 08-10-96

A BAND			B BAND		
CHAN	GRP	DBM	CHAN	GRP	DBM
331	19	-35	349	16	-70
332	20	-68	337	04	-89
330	18	-71	344	11	-89
315	03	-88	345	12	-94
314	02	-99	350	17	-95
329	17	-101	348	15	-96

MARKER 21 08:20:08 08-10-96

A BAND			B BAND		
CHAN	GRP	DBM	CHAN	GRP	DBM
331	19	-35	349	16	-80
332	20	-68	348	15	-85
330	18	-70	344	11	-87
315	03	-84	337	04	-87
326	14	-91	345	12	-95
314	02	-97	350	17	-98

MARKER 22 08:20:26 08-10-96

A BAND			B BAND		
CHAN	GRP	DBM	CHAN	GRP	DBM
331	19	-31	349	16	-77
332	20	-67	348	15	-85
330	18	-71	344	11	-87
315	03	-83	337	04	-88
326	14	-93	340	07	-98
321	09	-98	345	12	-98

MARKER 23 08:20:31 08-10-96

A BAND			B BAND		
CHAN	GRP	DBM	CHAN	GRP	DBM
331	19	-31	349	16	-79
332	20	-67	348	15	-85
330	18	-71	344	11	-87
315	03	-84	337	04	-88
326	14	-93	340	07	-98
321	09	-98	345	12	-98

MARKER 24 08:26:24 08-10-96

A BAND			B BAND		
CHAN	GRP	DBM	CHAN	GRP	DBM
331	19	-80	337	04	-31
326	14	-91	338	05	-66
315	03	-93	336	03	-68
320	08	-96	342	09	-75
313	01	-104	353	20	-93
327	15	-104	349	16	-93

GREATER ATLANTA
CELLULAR SYSTEM SURVEY

LOCATION

MAP **IDENT.**

MEASUREMENTS

3	14

Spalding Shopping Center
Spalding Rd
Norcross, GA

```
MARKER    26  08:27:39  08-10-96
        A BAND            B BAND
  CHAN GRP  DBM    CHAN GRP  DBM
▸ 331  19  -82     337  04  -35
  326  14  -85     338  05  -67
  320  08  -95     336  03  -69
  315  03  -96     342  09  -83
  332  20  -99     349  16  -86
  327  15 -103     348  15  -94
```

3	15

Deer Hollow & Spalding Rd.
Norcross, GA

```
MARKER    27  08:27:53  08-10-96
        A BAND            B BAND
  CHAN GRP  DBM    CHAN GRP  DBM
▸ 331  19  -86     337  04  -31
  326  14  -87     338  05  -66
  320  08  -91     336  03  -68
  315  03  -91     349  16  -84
  330  18  -99     342  09  -90
  332  20 -100     353  20  -93
```

```
MARKER    28  08:27:58  08-10-96
        A BAND            B BAND
  CHAN GRP  DBM    CHAN GRP  DBM
▸ 331  19  -83     337  04  -31
  326  14  -88     338  05  -66
  315  03  -89     336  03  -68
  320  08  -91     349  16  -84
  330  18  -99     342  09  -91
  332  20 -102     353  20  -94
```

3	16

Dunwoody Club & Mt. Vernon Rd
Dunwoody, GA

```
MARKER    29  08:43:50  08-10-96
        A BAND            B BAND
  CHAN GRP  DBM    CHAN GRP  DBM
▸ 321  09  -67     353  20  -48
  313  01  -84     354  21  -76
  323  11  -87     352  19  -79
  315  03  -92     336  03  -89
  322  10  -93     340  07  -90
  318  06  -93     338  05  -92
```

3	17

Jett Ferry Rd & Mt. Vernon Rd
Dunwoody, GA

```
MARKER    30  08:45:27  08-10-96
        A BAND            B BAND
  CHAN GRP  DBM    CHAN GRP  DBM
▸ 321  09  -78     353  20  -55
  313  01  -87     352  19  -84
  326  14  -87     354  21  -84
  327  15  -93     342  09  -90
  320  08  -93     348  15  -91
  329  17  -94     337  04  -93
```

4	18

Manhasset & Mt. Vernon Rd
Dunwoody, GA

```
MARKER    31  08:50:48  08-10-96
        A BAND            B BAND
  CHAN GRP  DBM    CHAN GRP  DBM
▸ 327  15  -51     350  17  -83
  318  06  -55     353  20  -85
  328  16  -75     336  03  -87
  329  17  -79     340  07  -88
  319  07  -80     349  16  -89
  324  12  -81     339  06  -89
```

```
MARKER    32  08:50:52  08-10-96
        A BAND            B BAND
  CHAN GRP  DBM    CHAN GRP  DBM
▸ 327  15  -53     339  06  -85
  318  06  -62     338  05  -89
  328  16  -78     347  14  -89
  329  17  -83     345  12  -89
  326  14  -85     353  20  -91
  315  03  -88     350  17  -92
```

GREATER ATLANTA
CELLULAR SYSTEM SURVEY

LOCATION
MAP   **IDENT.**

MEASUREMENTS

| 4 | 19 |

Vernon Oaks & Vernon Springs
Dunwoody, GA

MARKER 34 08:58:13 08-10-96

A BAND CHAN	GRP	DBM	B BAND CHAN	GRP	DBM
▸318	06	-44	350	17	-90
327	15	-65	347	14	-91
319	07	-71	338	05	-92
317	05	-75	342	09	-92
314	02	-83	336	03	-93
326	14	-90	349	16	-94

MARKER 35 08:59:09 08-10-96

A BAND CHAN	GRP	DBM	B BAND CHAN	GRP	DBM
▸318	06	-46	350	17	-93
327	15	-61	349	16	-94
319	07	-72	339	06	-94
317	05	-75	338	05	-96
329	17	-77	340	07	-97
315	03	-83	342	09	-97

| 4 | 20 |

Vernon Oaks & Mt. Vernon Rd
Dunwoody, GA

MARKER 36 08:59:54 08-10-96

A BAND CHAN	GRP	DBM	B BAND CHAN	GRP	DBM
▸318	06	-35	353	20	-88
327	15	-55	336	03	-90
319	07	-68	337	04	-90
317	05	-70	343	10	-92
328	16	-79	342	09	-93
313	01	-83	350	17	-93

MARKER 37 09:00:46 08-10-96

A BAND CHAN	GRP	DBM	B BAND CHAN	GRP	DBM
▸318	06	-38	339	06	-86
327	15	-58	336	03	-86
319	07	-69	340	07	-88
317	05	-70	350	17	-91
313	01	-79	343	10	-93
315	03	-82	351	18	-94

MARKER 38 09:00:50 08-10-96

A BAND CHAN	GRP	DBM	B BAND CHAN	GRP	DBM
▸318	06	-38	339	06	-86
327	15	-59	336	03	-87
319	07	-68	340	07	-89
317	05	-72	350	17	-90
313	01	-79	342	09	-91
315	03	-82	353	20	-93

| 5 | 21 |

Dunwoody MARTA Station
Hammond Drive
Dunwoody, GA

MARKER 39 09:14:13 08-10-96

A BAND CHAN	GRP	DBM	B BAND CHAN	GRP	DBM
▸315	03	-77	343	10	-41
323	11	-83	344	11	-68
332	20	-88	342	09	-71
331	19	-89	337	04	-75
321	09	-89	353	20	-79
325	13	-90	345	12	-83

| 5 | 22 |

Perimeter Ctr. Pky & Hammond Dr.
Dunwoody, GA

MARKER 40 09:14:50 08-10-96

A BAND CHAN	GRP	DBM	B BAND CHAN	GRP	DBM
▸315	03	-66	343	10	-43
323	11	-78	344	11	-71
332	20	-79	342	09	-74
331	19	-86	345	12	-76
321	09	-90	336	03	-82
319	07	-91	337	04	-87

GREATER ATLANTA
CELLULAR SYSTEM SURVEY

LOCATION		MEASUREMENTS
MAP	**IDENT.**	

5   **23**

Ashford Dunwoody & Ashwood Pky
Dunwoody, GA

```
MARKER    41  09:15:42  08-10-96
        A BAND              B BAND
  CHAN  GRP  DBM     CHAN  GRP  DBM
 ▸323    11  -83      343   10  -39
  315    03  -84      344   11  -68
  332    20  -86      342   09  -70
  325    13  -88      336   03  -81
  331    19  -88      345   12  -85
  321    09  -91      353   20  -85
```

5   **24**

Ashford Dunwoody & Fork Dr.
Dunwoody, GA

```
MARKER    42  09:20:40  08-10-96
        A BAND              B BAND
  CHAN  GRP  DBM     CHAN  GRP  DBM
 ▸322    10  -44      335   02  -80
  332    20  -66      337   04  -90
  323    11  -71      353   20  -90
  324    12  -75      342   09  -90
  321    09  -75      351   18  -91
  331    19  -85      347   14  -94
```

```
MARKER    43  09:20:59  08-10-96
        A BAND              B BAND
  CHAN  GRP  DBM     CHAN  GRP  DBM
 ▸322    10  -41      337   04  -80
  332    20  -55      335   02  -81
  323    11  -70      350   17  -83
  315    03  -72      347   14  -87
  321    09  -74      348   15  -89
  329    17  -78      351   18  -91
```

5   **25**

Ashford Dunwoody & Valley View
Dunwoody, GA

```
MARKER    44  09:21:53  08-10-96
        A BAND              B BAND
  CHAN  GRP  DBM     CHAN  GRP  DBM
 ▸322    10  -41      335   02  -83
  332    20  -54      345   12  -87
  323    11  -70      350   17  -90
  321    09  -72      353   20  -93
  324    12  -76      337   04  -96
  333    21  -82      347   14  -96
```

6   **26**

Dunwoody Village Shopping Center
Chamblee Dunwoody Road
Dunwoody, GA

```
MARKER    45  09:50:59  08-10-96
        A BAND              B BAND
  CHAN  GRP  DBM     CHAN  GRP  DBM
 ▸317    05  -66      352   19  -89
  332    20  -83      341   08  -89
  313    01  -87      339   06  -91
  318    06  -88      338   05  -94
  324    12  -92      335   02  -94
  323    11  -93      340   07  -95
```

6   **27**

Chamblee Dunwoody Rd & Center
Dunwoody, GA

```
MARKER    46  09:53:43  08-10-96
        A BAND              B BAND
  CHAN  GRP  DBM     CHAN  GRP  DBM
 ▸317    05  -48      335   02  -85
  318    06  -73      337   04  -95
  316    04  -79      352   19  -100
  324    12  -92      342   09  -103
  332    20  -93      345   12  -103
  329    17  -94      349   16  -103
```

6   **28**

Roberts Road & Fairfield
Dunwoody, GA

```
MARKER    47  09:54:52  08-10-96
        A BAND              B BAND
  CHAN  GRP  DBM     CHAN  GRP  DBM
 ▸317    05  -59      335   02  -91
  316    04  -84      353   20  -93
  318    06  -86      339   06  -95
  314    02  -92      345   12  -99
  313    01  -93      352   19  -101
  323    11  -96      342   09  -101
```